Demand Elasticities for Fresh Fruit at the Retail Level

by

Catherine Durham

and

James Eales*

* Authors are professors at Oregon State University Food Innovation Center and Purdue University, respectively. Funding from the Northwest Multicommodity Marketing Research Special Grant is gratefully acknowledged.

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Abstract

The obesity epidemic in the US and elsewhere has re-doubled efforts to understand determinants of the quality of consumers' diets. Part of the discussion has centered on the potential of "fat taxes" and/or the subsidization of the purchase of fresh fruits and vegetables to coax consumers to better diets. Whether this discussion has merit or not, fundamental to the debate are the demand elasticities of the commodities involved. This study employs weekly data from several retail stores on fruit prices and sales to estimate elasticities of individual fruits. Estimates show consumers are more responsive to price than has been found previously.

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Of course, it is not only the obesity epidemic that has focused attention on consumption of fresh fruits and vegetables in the US and around the world. Evidence is mounting that increasing fruit and vegetable consumption is likely to have all sorts of benefits in terms of reduced risks of heart disease, stroke, diabetes, hypertension, as well as obesity. Ness and Powles summarize the results obtained on the interplay between fruit and vegetable intake and heart disease in 1997 and the correlation between fruit and vegetable consumption and stroke in 1999. In a recent editorial, Bazzano summarizes more recent evidence on fruit and vegetable ingestion and all the conditions mentioned, above. Such evidence has re-doubled efforts to understand determinants of the quality of consumers' diets. Part of the discussion has centered on the potential of "fat taxes" and/or the subsidization of the purchase of fresh fruits and vegetables to coax consumers to better diets. Whether this discussion has merit or not, fundamental to the debate are the demand elasticities of the commodities involved. A search of the literature produced sixteen sources which included elasticities for fresh fruits in some form, not all of which are published. Of these, ten sources that contain estimates of elasticities for fresh fruit as an aggregate commodity and nine sources for individual fruit elasticities. The ranges of the elasticity estimates found are given in the following table. Sources and their estimates are given in Appendix A.

Table 1. Ranges of Fruit Own-Price Elasticity Estimates

Commodities	Fresh Fruit	Apples	Bananas	Oranges
Average	-0.60	-0.33	-0.46	-0.79
Minimum	-1.32	-0.72	-0.74	-1.14
Maximum	-0.21	-0.16	-0.24	-0.27

The simple averages of estimates from previous studies suggest fruits are price inelastic. From the ranges available in previous studies, it seems difficult to judge whether subsidization of fresh fruit consumption would have a significant effect on consumers' diets. Certainly, the average findings suggest that it would take large subsidies to induce a significant increase in fresh fruit consumption. However, most of the studies which have produced estimates of fruit price elasticities have been based on market-level data. Studies which have approached demand from the retail level have tended to find demands more responsive. For example, Hoch, et al., examined own-price elasticities at the retail level in a Chicago grocery chain and find most categories have demands that are elastic. This agrees with Hermman and Roeder, who state "Despite this evidence on price-inelastic food demand, it is well known that food retailers compete strongly by adopting very active pricing strategies. The latter observation might imply that food consumption in industrialised countries is price-inelastic at the aggregate level of market demand functions, but not necessarily at the point of sale."

In this paper, we produce new fresh fruit elasticity estimates obtained from a unique store-level data set. Previous studies have been undertaken at an aggregate market or a household level, so this study adds useful information to applied studies of food demand. The data is gathered from two supermarkets in the Pacific Northwest. From each store weekly observations were gathered on both sales and prices of fruits, as well as the total display space devoted to each fruit. The fruits include: apples, pears, bananas, oranges, grapes, and other fruit. Individual varieties are aggregated into their fruit category and weighted average prices calculated. These data will be used to estimate demands for fruit from each store using a little over half the data (80 of 141 weeks). The final 61 weeks are reserved to evaluate each demand system's out-of-sample forecasting ability. The system with the best forecasting performance in a minimum root mean square error sense will then be used to estimate elasticities over the entire sample. Based on preliminary attempts, models will incorporate both seasonal effects and display space for each fruit group.

In the next section four demand systems are proposed for evaluation and each is briefly discussed. In the third section of the paper the details of the data and descriptive statistics are given. The fourth section presents results of forecast evaluation and elasticity estimates from the chosen model. The final section summarizes and concludes.

Demand Systems Considered

The following demand systems will be evaluated: double-log, linear approximate almost ideal, almost ideal, and quadratic almost ideal systems. Experimentation with various types of dynamic models, such as Rotterdam, error correction, partial adjustment showed little or no improvement over static models for this problem.

The log-log demand system enjoys a long history in empirical work. Its coefficients are elasticities which are of primary interest here. However, there is little on theoretical grounds to justify this functional form (Deaton and Muellbauer). It is included because Kastens and Brester found that this functional form out performed theoretically consistent model when it came to forecasting, especially if theoretical restrictions were imposed. Therefore, the log-log system estimated will be:

$$\ln q_{it} = \beta_0 + \sum_{k=1}^{3} q_{ik} Q_{kt} + \sum_{l=1}^{6} d_{il} TD_{lt} + \sum_{j=1}^{n} e_{ij} \ln p_{jt} + e_i \ln x_t + \varepsilon_{it}$$
$$s.t. \sum_{j=1}^{n} e_{ij} + e_i = 0 \ \forall \ i,$$
$$e_{ji} = \frac{\bar{w}_i}{\bar{w}_j} e_{ij} + \bar{w}_i (e_i - e_j) \ \forall \ j > i$$

In this (and the other models, as well) *Qs* represent seasonal dummies and *TDs* are the total display area for each fruit. The restrictions in the second line are those implied by homogeneity and those in third are implied by symmetry which is imposed at the sample means. The errors in all models are assumed multivariate normal with zero means and correlated across equations in the same time period, but not heteroskedastic in an equation or correlated across time periods. The log-log model does not add up, so all six equations are estimated. To make comparisons to other models, forecasts are exponentiated and then combined with the future prices and expenditure to generate forecasts of expenditure shares. These are then used to calculate root mean square errors (RMSE).

The AIDS model has expenditure shares, *w*, as dependent variables, as do the subsequent models. This is still one of the most used demand systems in empirical studies.

$$w_{it} = \alpha_i + \sum_{k=1}^{3} q_{ik} Q_{kt} + \sum_{l=1}^{6} d_{il} TD_{lt} + \sum_{j=1}^{n} \gamma_{ij} \ln p_{jt} + \beta_i (\ln x_t - \ln P_t) + \varepsilon_{it}$$
$$where \ \ln P_t = \alpha_0 + \sum_j \alpha_j \ln p_{jt} + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_{it} \ln p_{jt}$$
$$s.t. \sum_{j=1}^{n} \gamma_{ij} = 0 \ \forall \ i,$$
$$\gamma_{ij} = \gamma_{ji} \ \forall \ i \neq j$$

The third line gives homogeneity restrictions and the fourth symmetry restrictions. The translog price index is estimated (in both the AIDS and QUAIDS models) assuming α_0 is zero.

The LA/AIDS model:

$$w_{it} = \alpha_i + \sum_{k=1}^{3} q_{ik} Q_{kt} + \sum_{l=1}^{6} d_{il} TD_{lt} + \sum_{j=1}^{n} \gamma_{ij} \ln p_{jt} + \beta_i (\ln x_t - \ln P_t^*) + \varepsilon_{it}$$

$$where \ \ln P_t^* = \sum_j w_{jt} \ln \frac{p_{jt}}{\bar{p}_j}$$

$$s.t. \ \sum_{j=1}^{n} \gamma_{ij} = 0 \ \forall \ i,$$

$$\gamma_{ij} = \gamma_{ji} \ \forall \ i \neq j$$

There are a number of studies which look at what approximation to use for the price index, eg. Moschini, Asche and Wessells, and Buse, with some continuing disagreement. It seems, however, to make little practical difference.

The QUAIDS model:

$$w_{it} = \alpha_i + \sum_{k=1}^{3} q_{ik} Q_{kt} + \sum_{l=1}^{6} d_{il} TD_{lt} + \sum_{j=1}^{n} \gamma_{ij} \ln p_{jt} + \beta_i (\ln x_t - \ln P_t) + \frac{\lambda_i}{\prod_{j=1}^{n} \beta_j} (\ln x_t - \ln P_t)^2 + \varepsilon_{it}$$

$$where \ \ln P_t = \alpha_0 + \sum_j \alpha_j \ln p_{jt} + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_{it} \ln p_{jt}$$

$$s.t. \ \sum_{j=1}^{n} \gamma_{ij} = 0 \ \forall \ i,$$

$$\gamma_{ij} = \gamma_{ji} \ \forall \ i \neq j$$

The QUAIDS model is a rank three system which allows for more flexible representation of expenditure effects, which could also effect the price elasticities, so it is included, as well.

The Data

The data used for this study included weekly dollar sales and quantities sold from two retail grocery stores within the same chain. The produce sections in each store had some differences in organization and methods for displaying produce and were located in different demographic areas in the Portland, Oregon metropolitan area.

Using Census data from Congressional districts adjacent to the two stores, the areas around the stores vary demographically in the following ways. Customers in store 1's neighborhood are more diverse with 12 % reporting themselves to be Hispanic (10% Mexican) and 9% Asian background, while Store 2 is located in a neighborhood with 96% reporting their race as white and only 3.2 % reporting Hispanic of any race. Per capita incomes are $10,000 lower in the Store 1 neighborhood, with larger families contributing largely to the difference: median household incomes are similar in the lower 50,000-dollar range. Median home costs are nearly 30,000 higher in the Store 2 neighborhood at just under $190,000.

Weekly store visits entailed data collection on apples, bananas, pears, oranges, grapes and other hand fruit. Information collected included display prices, advertisements in flyers and in store promotions, area of display, and point-of-purchase material size. The stores provided printouts of dollar sales and units sold.

While unit values could be calculated from the sales and quantities supplied by the stores, actual prices are also collected from at the point of display each week, this means that the prices entered are based on what the consumer saw at the display area. Quantities are usually reported in pounds, but when the product is sold in other formats such as a bag, a box, or in as for example '2 for a dollar', quantities are converted to pounds and prices are converted to a price per pound equivalent. Then aggregated fruit prices are calculated as a weighted average price-category sales divided by total pounds sold in the category.

The in-store promotion and display characteristics were examined in preliminary analysis: after price, the in-store characteristic that had the most critical impact on demand estimates was the display area given to each product. For this reason display area is included as part of the demand system, other variables, while influential at a disaggregate level, are less important after aggregation. Descriptive statistics for the variables employed are given in table 2.

Table 2. Descriptive Statistics

	Store 1		Store 2	
Variables	Average	Std. Dev.	Average	Std. Dev.
Apple Price	0.947	0.250	1.072	0.298
Pear Price	0.895	0.263	1.046	0.214
Banana Price	0.592	0.177	0.649	0.190
Orange Price	0.750	0.397	0.777	0.399
Grape Price	1.945	0.708	2.120	0.727
Other Price	1.620	0.412	1.508	0.370
Apple Share	0.207	0.053	0.230	0.056
Pear Share	0.055	0.033	0.064	0.039
Banana Share	0.237	0.048	0.218	0.038
Orange Share	0.113	0.055	0.102	0.047
Grape Share	0.144	0.060	0.161	0.059
Other Share	0.246	0.118	0.225	0.108
X	10861	2075	8201	1389
Apple Display	11.582	3.235	14.166	7.346
Pear Display	4.095	1.855	4.164	2.639
Banana Display	2.417	0.208	2.438	0.387
Orange Display	7.413	4.674	6.539	3.342
Grape Display	3.473	1.533	1.446	0.809
Other Display	9.355	3.699	9.044	3.989

Display size varies by season, and is more variable in one store than the other. Increasingly one store has devoted a fixed level of space to apples within one set of displays with specials and expansions into secondary free-standing displays at some times. The same basics apply to pears though display of other fruits is more variable. In the second store there is more random display between varieties and fruits though expansions to secondary displays are also common. Because sales and specials are also associated with expansions, it is important to consider display area in models to evaluate price elasticity.

Forecasting Performance

Each model was estimated using the first 80 weeks of data. Those estimates were then combined with the actual values of the right-hand-side variables for weeks 81 through 141 to forecast the dependent variables for each model. The log-log models forecasts are exponentiated and used to calculate a forecast expenditure share for each fruit to make comparisons possible. Root mean square errors (RMSEs are multiplied by 100) are then calculated for each model for each fruit and then summed. Results are given in table 3 and 4.

Table 3. Out-of-Sample Forecast RMSEs*100 - Store 1

Fruit	log-log	AIDS	LAAIDS	QUAIDS
Apple	**3.33**	4.36	4.37	4.92
Pear	1.70	1.77	1.81	**1.62**
Banana	4.46	3.63	3.74	**3.18**
Orange	5.65	4.98	5.30	**4.72**
Grape	5.26	**5.20**	5.38	5.46
Other	**9.34**	9.46	9.43	9.44
Sum	29.75	29.41	30.03	**29.33**

Estimation sample: weeks 1-80; forecast sample: weeks 81-141. Bold indicates the entry is the smallest in that row.

Table 4. Out-of-Sample Forecast RMSEs*100 - Store 2

Fruit	log-log	AIDS	LAAIDS	QUAIDS
Apple	**4.21**	4.45	4.59	4.52
Pear	**2.17**	2.35	2.33	2.30
Banana	4.81	4.54	**4.52**	4.57
Orange	4.99	**3.60**	3.69	3.61
Grape	**4.14**	5.19	5.14	4.67
Other	9.42	9.12	8.87	**8.71**
Sum	29.75	29.25	29.14	**28.37**

Estimation sample: weeks 1-80; forecast sample: weeks 81-141. Bold indicates the entry is the smallest in that row.

No model dominates for all fruits at either store, but the QUAIDS model has the smallest RMSE in three of six case for store one, while the log-log model has the smallest RMSE in three of six cases for store two. The worst forecasts in both stores are for other fruit as should be expected. At the bottom of each column the sum of the RMSEs for each model are given. For both stores, the QUAIDS model produces the lowest sum.[1] It will be used in the next section to produce elasticity estimates from the overall data sets for each store.

[1] Likelihood ratio tests for the QUAIDS versus the AIDS models were 37.3 for store 1 and 12.0 for store 2. The 95% cutoff for a chi-square with 5 degrees of freedom is 11.1. A Chow test for pooling the two stores produced a likelihood ratio statistic of 254.2 and a 95% cutoff of a chi-square with 75 degrees of freedom is 96.2.

Fresh Fruit Elasticities

Elasticities for the QUAIDS model are calculated as follows (Banks, Blundell, and Lewbel). Differentiate the share equations with respect to the logarithms of expenditure and of prices:

$$\mu_i \equiv \frac{\partial w_i}{\partial \ln x} = \beta_i + \frac{2\lambda_i}{\prod_k p_k^{\beta_k}}(\ln x - \ln P)$$

$$\mu_{ij} \equiv \frac{\partial w_i}{\partial \ln p_j} = \gamma_{ij} - \mu_i(\alpha_j + \sum_k \gamma_{jk}\ln p_k) - \frac{\lambda_i \beta_j}{\prod_k p_k^{\beta_k}}(\ln x - \ln P)^2$$

then $e_i = \mu_i / w_i + 1$ and $e_{ij} = \mu_{ij} / w_i - \delta_{ij}$. Prior to estimation, all prices were normalized to have sample mean = 1. This simplifies the calculations of the elasticities somewhat as now the μs are:

$$\mu_i \equiv \frac{\partial w_i}{\partial \ln x} = \beta_i + 2\lambda_i(\ln x)$$

$$\mu_{ij} \equiv \frac{\partial w_i}{\partial \ln p_j} = \gamma_{ij} - \mu_i\alpha_j - \lambda_i\beta_j(\ln x)^2$$

and the sample average shares are used. Standard errors for the elasticities are calculated using the delta method and assuming the average shares are constants.2

Elasticity estimates are given separately for each store in tables 5 and 6. All fruits are own-price elastic with the exception of bananas which are slightly inelastic, but not significantly so. The only significant complementary relationship (The fruit salad effect?) is between oranges and

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2 Complete estimation results for both systems are given in Appendix B.

other fruits at store 1. All other significant cross-price elasticities show that fruits are substitutes at both stores. The agreement across stores is striking, as well.

Table 5. Estimated Elasticities from Store 1.

	Apples	Pears	Bananas	Oranges	Grapes	Other
Apples	**-1.13**	0.04	0.03	0.08	**0.18**	0.11
Std Error	0.05	0.10	0.06	0.36	0.09	0.12
Pears	**0.18**	**-1.44**	0.10	0.07	**0.25**	0.07
Std Error	0.09	0.10	0.22	0.06	0.06	0.10
Bananas	0.02	0.01	**-0.98**	**0.08**	**0.11**	0.02
Std Error	0.04	0.02	0.04	0.03	0.02	0.14
Oranges	0.01	0.01	0.00	**-1.37**	0.25	**-0.30**
Std Error	0.06	0.05	0.08	0.08	0.43	0.09
Grapes	0.11	0.07	0.04	0.27	**-1.62**	0.01
Std Error	0.30	0.19	0.44	0.39	0.06	0.43
Other	-0.01	0.00	-0.10	-0.14	-0.07	**-0.99**
Std Error	0.18	0.09	0.31	0.58	0.10	0.21

Bolded entries are at least twice their standard errors. Standard errors are calculated by the delta method assuming mean shares are fixed.

Table 6. Estimated Elasticities from Store 2.

	Apples	Pears	Bananas	Oranges	Grapes	Other
Apples	**-1.19**	0.06	**0.07**	0.06	**0.16**	0.03
Std Error	0.04	0.11	0.03	0.28	0.03	0.05
Pears	**0.19**	**-1.68**	**0.13**	0.02	**0.25**	0.16
Std Error	0.08	0.11	0.06	0.05	0.06	0.32
Bananas	**0.10**	0.05	**-0.90**	0.02	**0.12**	-0.07
Std Error	0.05	0.04	0.07	0.08	0.03	0.12
Oranges	0.07	0.01	-0.02	**-1.30**	0.27	-0.08
Std Error	0.06	0.03	0.05	0.06	0.50	0.21
Grapes	0.12	0.08	0.02	0.15	**-1.67**	0.02
Std Error	0.43	0.45	0.50	0.62	0.05	0.93
Other	-0.07	0.03	-0.20	-0.06	0.02	**-0.99**
Std Error	0.19	0.28	0.18	0.83	0.28	0.42

Bolded entries are at least twice their standard errors. Standard errors are calculated by the delta method assuming mean shares are fixed.

Summary and Conclusions

Data from two grocery stores in the Pacific Northwest are used to judge between four different demand systems based on out-of-sample forecasting. The model with the lowest overall root mean square error was the quadratic almost ideal (QUAIDS) for both stores, although the forecasting ability of none of the four demand systems was probably significantly worse. The QUAIDS model was then re-estimated for both stores using the entire data set and elasticity estimates and their standard errors were calculated at the sample mean shares. These turned out to be more elastic with respect to own-price than the averages of previous estimates and toward the more elastic of the previous estimates. Few of the cross-price elasticities were significant, but of those that were all but one showed a slight substitutability between the fruits.

So what does it mean? Since our data come from two stores in the Pacific Northwest, it is heroic to generalize. However, the data from the stores represent actual purchases rather than recalled consumption as one would find in the Continuing Survey of Food Intake by Individuals or the disappearance data gathered by the USDA and so is more representative of consumers' actual behavior. Also, since the stores are located in a major metropolitan area they are likely to be representative of other urban populations.

Our estimates of the sensitivity of fresh fruit to price changes is considerably larger than most of the previous estimates. According to the Center for Disease Control (CDC website) Americans are currently eating about 3 to 3.5 servings of fresh fruit and vegetables per day. To reach the recommended 5 servings per day would require a consumption increase of between 40 & 70 percent. At the average of previous elasticity estimates given in table 1, a twenty percent price subsidy would result in increased consumption of fresh fruit by between 7 and 18 percent. A twenty percent subsidy of fruits would result in increases in consumption of the fruit varieties of between fourteen and twenty-eight percent and an average increase in fruit consumption of 20%. This is still far short of the increases needed to meet the recommended daily consumption, but it lends more support to the inclusion of subsidies in an overall strategy to improve consumers' diets than would previous estimates.

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Appendix A

Table A1. Previous Estimates of Own-Price Elasticities for Fresh Fruit

Study	Fruit
Blanciforti, Green, & King 1986 (table 5.8)	-0.27
You, Epperson, & Huang 1996 (table 1)	-0.401
You, Epperson, & Huang 1998 (table 1)	-0.273
Feng & Chern 2000 (table 3)	-0.82
Huang & Lin 2000 (table 4)	-0.72
Reed & Clark 2000 (table 9)	-0.208
Katchova & Chern 2004 (table 7)	-1.32
Reed, Levedahl, & Hallahan 2005 (table 3)	-0.979
Richards & Patterson 2005 (table 4)	-0.67
Lechene (Table 6.2 & 6.3)	-0.29

Table A2. Previous Estimates of Own-Price Elasticities for Fresh Fruit Varieties

Study	Apples	Bananas	Oranges
George & King 1971 (table 5)	-0.72	-0.61	-0.66
Brown, Lee, & Seale 1992 (table 3)	-0.268	-0.277	-0.267
He, Huang, & Houston 1995(table 3)	-0.488	-0.243	-0.567
You, Epperson, & Huang 1996 (table 2)	-0.165	-0.424	-1.135
Huang 1996 (Table 3 from Huang ERS TB#1821)	-0.19	-0.499	-0.849
You, Epperson, Huang 1998 (table 2)	-0.196	-0.334	-1.036
Richards, Gao, & Patterson 1999 (table 3)	-0.242	-0.402	-0.855
Huang 1999 (table A1)	-0.190	-0.499	-0.849
Brown & Lee 2002 (table 3)	-0.524	-0.535	-0.673
Schmitz & Seale 2002 (table 5)		-0.74	-1.05

Appendix B

Table B1. Estimates of QUAIDS Model

Store 1	Apples*	Std. Error	Pears	Std. Error	Bananas	Std. Error	Oranges	Std. Error	Grapes	Std. Error	Other Fruit
Apple Price	**-0.075**	0.016	-0.002	0.007	**-0.063**	0.019	**0.097**	0.041	**0.021**	0.009	0.022
Pear Price	-0.002	0.007	**-0.027**	0.007	-0.015	0.011	0.034	0.025	**0.010**	0.004	0.000
Banana Price	**-0.063**	0.019	-0.015	0.011	**-0.122**	0.028	**0.229**	0.031	0.002	0.020	-0.031
Orange Price	**0.097**	0.041	0.034	0.025	**0.229**	0.031	**-0.498**	0.045	0.068	0.044	0.070
Grape Price	**0.021**	0.009	**0.010**	0.004	0.002	0.020	0.068	0.044	**-0.089**	0.011	-0.012
Other Price	0.022		0.000		-0.031		0.070		-0.012		-0.049
X	-0.049	0.027	-0.019	0.016	**-0.140**	0.021	**0.311**	0.016	-0.022	0.031	-0.081
X^2	-0.001	0.002	0.000	0.001	**0.004**	0.001	**-0.014**	0.001	0.002	0.002	0.008
Intercept	**0.807**	0.131	**0.179**	0.075	**1.252**	0.101	**-1.597**	0.074	**0.272**	0.146	0.087
Quarter 1	-0.001	0.009	**-0.011**	0.005	**0.024**	0.010	0.010	0.010	0.018	0.012	-0.040
Quarter 2	**-0.037**	0.009	**-0.019**	0.005	-0.005	0.010	**0.024**	0.010	**-0.026**	0.012	0.063
Quarter 3	**-0.034**	0.014	-0.003	0.007	-0.031	0.016	**-0.041**	0.015	-0.020	0.018	0.129
Apple Display	**0.004**	0.001	0.001	0.000	**-0.002**	0.001	-0.002	0.001	**-0.003**	0.001	0.002
Pear Display	-0.002	0.002	**0.011**	0.001	-0.001	0.003	0.000	0.003	0.004	0.003	-0.012
Banana Display	**-0.037**	0.014	-0.006	0.007	-0.012	0.016	0.029	0.015	**-0.045**	0.018	0.071
Orange Display	0.001	0.001	**0.001**	0.000	**0.002**	0.001	0.001	0.001	0.000	0.001	-0.005
Grape Display	0.003	0.002	-0.001	0.001	0.002	0.002	-0.001	0.002	**0.009**	0.002	-0.012
Other Display	**-0.003**	0.001	0.000	0.000	**-0.003**	0.001	**-0.002**	0.001	-0.001	0.001	0.009
R-Square	0.713		0.809		0.531		0.683		0.598		
Durbin-Watson	1.543		1.364		1.497		1.739		2.047		

* Estimates in bold are at least twice their standard errors (in absolute value).

Table B2. Estimates of QUAIDS Model

Store 2	Apples*	Std. Error	Pears	Std. Error	Bananas	Std. Error	Oranges	Std. Error	Grapes	Std. Error	Other Fruit
Apple Price	**-0.067**	0.015	0.016	0.009	-0.005	0.011	0.052	0.043	0.011	0.028	-0.006
Pear Price	0.016	0.009	-0.005	0.012	0.003	0.009	-0.044	0.040	0.045	0.028	0.030
Banana Price	-0.005	0.011	0.003	0.009	-0.020	0.015	-0.020	0.065	0.043	0.043	-0.001
Orange Price	0.052	0.043	-0.044	0.040	-0.020	0.065	**-0.375**	0.069	**0.249**	0.050	0.138
Grape Price	0.011	0.028	0.045	0.028	0.043	0.043	**0.249**	0.050	**-0.253**	0.061	-0.095
Other Price	-0.006		0.030		-0.001		0.138		-0.095		-0.066
X	**-0.337**	0.034	**0.360**	0.032	**0.165**	0.049	**0.277**	0.027	**-0.178**	0.036	-0.118
X^2	0.000	0.002	-0.002	0.002	-0.005	0.003	**-0.015**	0.002	**0.012**	0.002	0.010
Intercept	**0.590**	0.152	-0.089	0.142	**0.490**	0.220	**-1.173**	0.108	**0.746**	0.162	0.436
Quarter 1	0.007	0.010	-0.007	0.006	0.007	0.010	**0.020**	0.009	0.012	0.012	-0.040
Quarter 2	**-0.028**	0.011	**-0.026**	0.006	-0.006	0.012	0.011	0.010	-0.002	0.013	0.050
Quarter 3	-0.013	0.013	**-0.021**	0.007	-0.017	0.013	**-0.051**	0.011	-0.011	0.015	0.114
Apple Display	**0.003**	0.000	0.000	0.000	0.000	0.001	-0.001	0.000	-0.001	0.001	-0.002
Pear Display	**0.004**	0.002	**0.008**	0.001	-0.002	0.002	**-0.004**	0.001	0.003	0.002	-0.008
Banana Display	**-0.017**	0.007	0.000	0.004	0.004	0.008	0.012	0.007	0.001	0.009	-0.001
Orange Display	-0.002	0.001	**0.000**	0.001	-0.001	0.001	**0.002**	0.001	0.000	0.001	0.001
Grape Display	-0.004	0.003	-0.005	0.002	-0.001	0.004	0.004	0.003	**0.012**	0.004	-0.006
Other Display	-0.001	0.001	0.000	0.000	**-0.003**	0.001	**-0.002**	0.001	-0.001	0.001	0.007
R-Square	0.759		0.849		0.383		0.720		0.653		
Durbin-Watson	1.685		1.772		1.693		1.542		1.807		

* Estimates in bold are at least twice their standard errors (in absolute value).